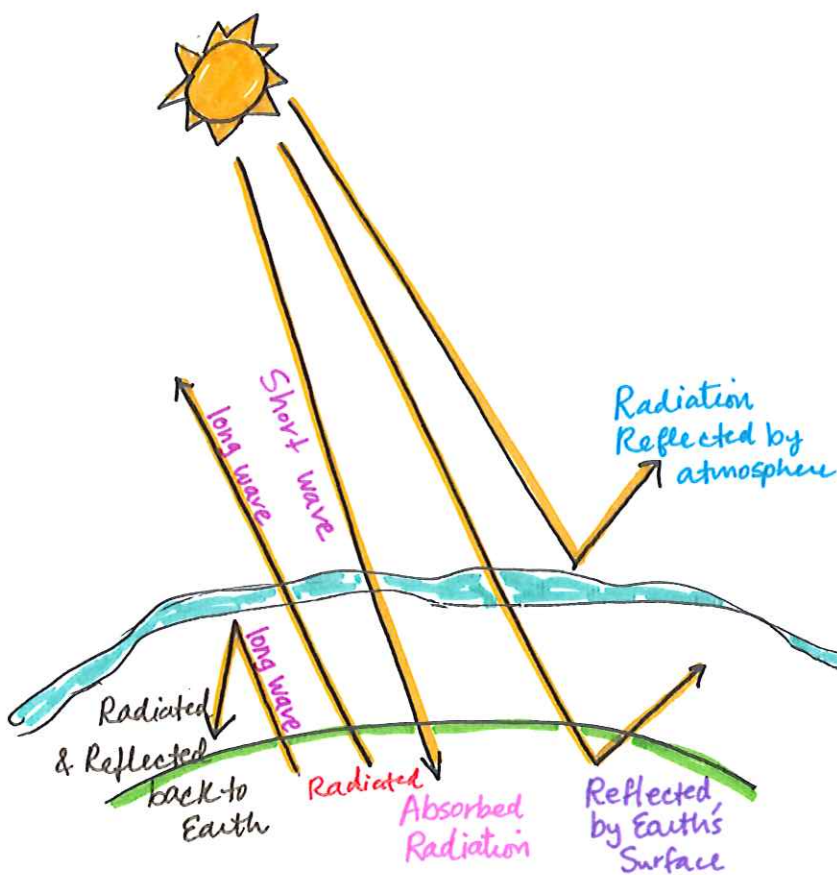


Greenhouse Gasses & Global Temperature

6.1.1 Describe the role of greenhouse gases in maintaining mean global temperature



3 Types of UV

* UV-A → long wavelength
formation of Vitamin D
too much = cancer
burns

* UV-B → Medium wavelength
can lead to eye
problems + cancer if
overexposed.

* UV-C → short wavelength -
absorbs in stratos.
ozone.

Stratospheric ozone
* Remember as ↓s. ozone
more short wave
UV gets in

Greenhouse Effect

→ Keeps Earth's temperature
perfect for life on Earth.

↓
greenhouse gasses (GHG's) Absorb UV wavelength.
if the GHG's didn't absorb UV than that heat
would leave + the Earth would cool down.

↳ GHG's

CO₂ (carbon dioxide)

CH₄ (methane)

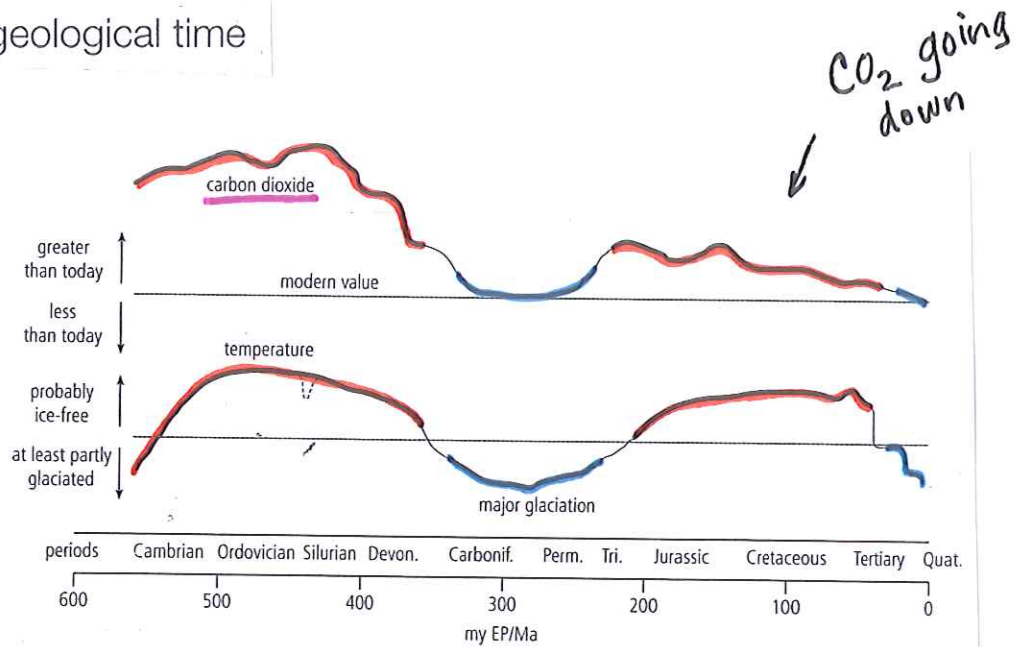
N₂O (nitrous oxide)

H₂O_g (water vapour)

Greenhouse gases in geological time

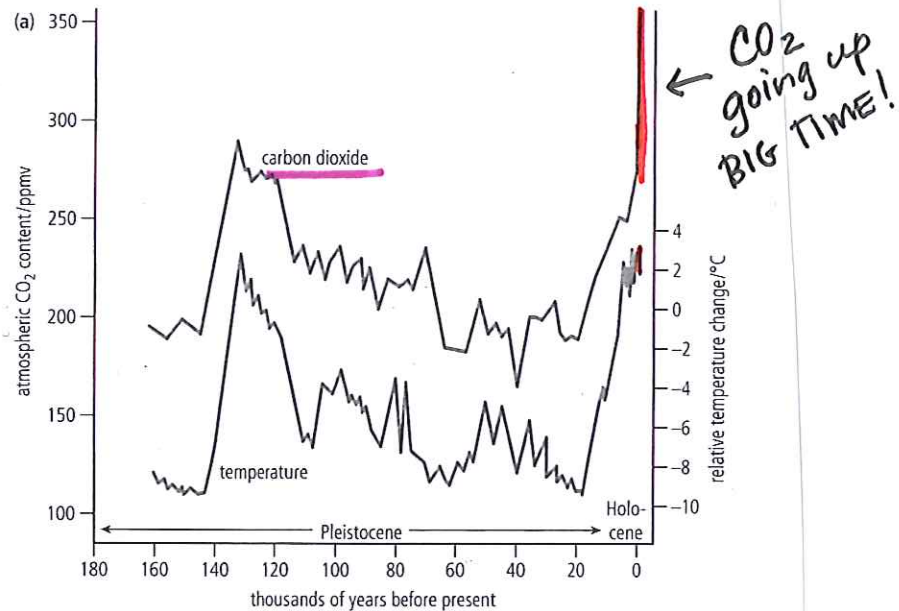
BIG PICTURE →

Mostly WARM-
COLDER RIGHT
NOW



SMALLER
PICTURE →

Mostly cooler →
getting warm

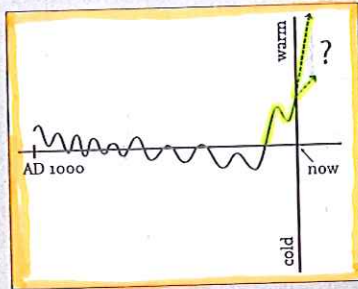


↳ How does this IMPACT TEMPERATURE?

Four ways to think of past and future climate

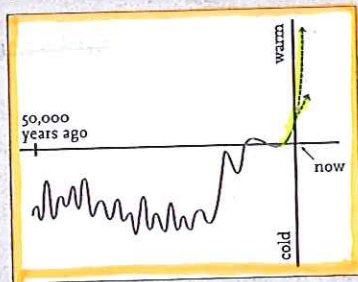
↳ It's All About SCALE

► **Over hundreds of years** Around AD 1000, Earth was nearly as warm as it is now. After that, temperatures over much of the planet cooled by around $0.2\text{--}0.5^\circ\text{C}$ ($0.4\text{--}0.8^\circ\text{F}$), mostly during the period known as the Little ice age, from the 1300s to around 1850. The global average has since rebounded by nearly 1°C (1.8°F) as human-produced greenhouse gases have increased. This century is projected by the IPCC to warm by $1.4\text{--}5.8^\circ\text{C}$ ($2.5\text{--}10.5^\circ\text{F}$). Further warming after 2100 could be substantial if greenhouse emissions continue to increase through this century, and the delayed response of ice sheets and deep oceans to warming could produce major sea-level rise over several centuries.



Over Hundreds of years

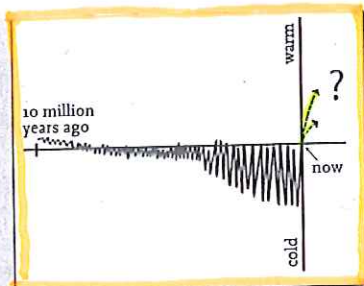
► **Over tens of thousands of years** The most recent ice age began about 115,000 years ago and ended about 11,500 years ago. Then came a dramatic warm-up, which lasted until about 3000 BC. Since then, Earth's temperature has changed relatively little, with a very slight cooling interrupted by warmer periods and punctuated by the last century's sharp temperature rise. More than a thousand years from now, after humans have exhausted fossil fuels and the resulting greenhouse gases have left the atmosphere naturally (mostly through slow absorption by the ocean), we may return to cooler times. If the



Over 10's of thousands of years

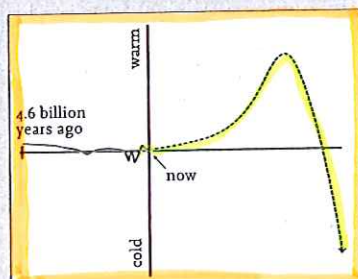
length of the last interglacial is any guide, we're due for another ice age in the next few thousand years, although some scientists believe it's more likely to take 20,000 years or more. It's even possible that a mix of polar melting, land-use changes and slowly waning greenhouse-gas concentrations could postpone the next ice age for an undetermined period.

► **Over tens of millions of years** A gradual, though sometimes erratic, cooling trend has been under way for at least 55 million years, perhaps due in part to carbon dioxide removed by weathering atop the growing Himalayas. Northern Hemisphere glaciations began about 2.7 million years ago. Warm and cool periods come and go atop this overall cooling. Simple extrapolation would keep Earth on this extremely slow cooling trend, although there's no evidence to tell us how long that might last.



Over 10's of millions of years

► **Over billions of years** On this scale, the details are blurry but the overall picture is clear. Changes in greenhouse-gas levels have so far kept our climate relatively stable (not too hot or cold for life) even though the Sun's output has risen by more than a third since the solar system was formed around 4.6 billion years ago. The Sun will continue to heat up and eventually undergo changes to its size and structure, producing a climate on Earth hot enough to evaporate the oceans and make life impossible. Eventually, the sun will shrink and start to fade, with the solar system reaching its cold "final configuration" in around twelve billion years.



Over Billions of years